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Learning strategies as predictors for academic achievement in 15-year-olds. Comparisons between Poland, the Czech Republic, Germany, Hungary and Slovakia

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The paper reports a study addressing influence of learning strategies on academic achievement in mathematics, reading and science internationally, with comparisons between Poland's neighbouring countries. Data from the PISA 2009 study was used to build multiple multilevel hierarchical regression models, with control variables for student, school and at country level. Based on the model developed by Chiu, Chow and McBride-Chang (2007), prior achievement, student family background, school environmental characteristics and national economic and cultural contexts were controlled for, allowing assessment of the effects of learning strategies. Higher dependency on memorisation was associated with lower scores in all domains, elaboration was a negative predictor of reading and positive of mathematics and science, while use of metacognitive strategies was associated with higher scores in all domains investigated. The effect of metacognitive strategies was particularly strong in Poland, as compared with neighbouring countries.

Keywords: education, academic achievement, cultural context, learning strategies, metacognitive strategies.

Learning is not a simple receptive process but requires a series of intensively coordinated operations to consolidate new information into the broader structure of individual knowledge. More information is increasingly generated and more efficient methods for learning need to be acquired to maximise ability for its assimilation. Not only are different channels and methods for communication and knowledge transfer by teachers needed, but so too are more effective student approaches.

New developments in the science of learning emphasise the importance of active

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participation (Somuncuoglu and Yildirim, 1999). Rather than passive reception and information processing, students are expected to learn by construction of meaning, critical thinking and efficient association of material with existing knowledge. They should be able to determine how this new knowledge can be applied to solve, not only academic, but also complex, real life problems (OECD, 2009a). Students with well-developed management of learning skills can set appropriate goals, using existing knowledge to direct learning for selection of strategies appropriate to the task at hand (OECD, 2009a). Studies show that of the individual traits, learning strategies are among the most promising in offering explanation for academic achievement (e.g., Lau and Chan, 2001; Law, Chan and Sachs, 2008; Valentine, DuBois and Cooper, 2004).

Learning strategies

> Learning strategies are cognitive plans oriented toward successful task performance. Strategies include such activities as selecting and organizing information, rehearsing material to be learned, relating new material to information in memory and enhancing meaningfulness of material. Strategies also include techniques to create and maintain a positive learning climate, for example, ways to overcome test anxiety, enhance self-efficacy, appreciate the value of learning and develop positive outcome expectations and attitudes (Schunk and Zimmerman, 2003, p. 62).

Mental exercises using these cognitive processes assist learners' understanding of new information (Chiu, Chow and Mcbride-Chang, 2007), facilitating faster, more enjoyable, independent and efficient learning and rendering it more transferable to new contexts (Hsiao and Oxford, 2002). Learning strategies allow students to take control over the learning process, offering what should be an essential skill to those intending to adopt a self-regulated approach to learning (Schunk and Zimmerman, 2003).

Students skilled at self-regulated learning understand their strengths and weaknesses. They approach study with an arsenal of learning strategies to achieve their goals with an understanding of when and how to implement which approach. Expert learners also know whether they have mastered the required skills (e.g., Allen, 2003; Isaacson and Fujita, 2006).

Although definitions and classifications for learning strategies often vary according to a researcher's theoretical orientation (e.g., Conti and Fellenz, 1991; Dansereau, 1978; Lee, 2002; O'Malley and Chamot, 1990; Oxford, 1990; Peng, Siriyothin and Lian, 2014; Sheorey and Mokhtari, 2001; Weinstein and Mayer, 1986; Zimmerman and Martinez Pons, 1986), a common conceptualisation of cognitive learning strategies generally includes surface and deep cognitive learning (e.g., Areepattamannil, 2014; Demir and Kiliç, 2010; Diseth, 2013; Laskey and Hetzel, 2010; Lee, 2002; Somuncuoglu and Yildirim, 1999) and metacognitive learning strategies (e.g., Areepattamannil, 2014; Bransford, Brown and Cocking, 1999; Isaacson and Fujita, 2006; Kaur and Areepattamannil, 2012; Lee, 2002; Paris and Paris, 2001; Pintrich and De Groot, 1990; Zimmerman, 1989).

Students who use cognitive learning strategies, integrate new material with prior knowledge (Wong, 2004), by adopting strategies such as acquisition, selection and organisation of information, rehearsal of material, relation of new information to that already in their memory and retaining and retrieving different types of knowledge (Lee, 2002). Cognitive learning strategies are classified into: surface cognitive strategies, which help to encode new information into short-term memory only and deep cognitive strategies, which facilitate long-term retention of the target information (Somuncuoglu and Yildirim, 1999).

Surface learning strategies are learning processes restricted to selective memorisation, rehearsal and rote learning that chiefly allow students to reproduce learning materials (Baeten, Kyndt, Struyven and Dochy, 2010; Chapman, 2003; Diseth, 2013). Use of these strategies is motivated mainly by fear of failure and a desire to keep out of trouble, minimising the effort needed to reach understanding (Baeten et al., 2010; Diseth, 2013). This may originate from the fact that some students' study goals are simply to fulfil situational demands, such as completing assignments and successfully finishing courses. Surface strategies may, in these cases, allow survival of tests and examinations with minimal work. As a consequence, the learning process does not extend beyond the bare essentials. Students who adopt these low-level strategies do not attempt to organise the learning materials or relate them to personal experience. Surface strategies represent low-quality learning which may be subsequently detrimental to future academic achievement (McInerney, Cheng, Mok and Lam, 2012). Surface learning strategies might also be the only possibilities for students with lower cognitive ability.

Deep cognitive learning strategies represent more sophisticated learning processes aimed at understanding (Chapman, 2003) by organising new information, relating ideas and self-monitoring of the understanding of learned materials (McInerney et al., 2012). Grabbing meaning by actively elaborating information (Tang and Neber, 2008) goes hand in hand with intrinsic interest and appropriate engagement with the task. Thus deep learning strategies are expected to have facilitative effects on academic learning and performance (Stefanou and Salisbury-Glennon, 2002) and are predictors for good performance on academic tasks (McInerney et al., 2012). According to Zimmerman and Martinez Pons (1990; see Tang and Neber, 2008), highly gifted students use deep learning strategies more intensively and more regularly than their less gifted peers.

Although a purely cognitive concept for learning could assist academic learning and performance, it is not sufficient. To achieve successful use of cognitive learning strategies, these processes should be managed at a metacognitive level, including metacognitive control and metacognitive knowledge (e.g., Billing, 2007; Lewalter, 2003; Kuensting, Kempf and Wirth, 2013). Metacognitive knowledge is the knowledge of general strategies that might be applied to various tasks, the conditions under which these strategies might be used, the extent to which the strategies are efficient and knowledge of self (e.g., Lewalter, 2003; Pintrich, 2002). The ability to use metacognitive knowledge strategically to attain cognitive objectives is termed metacognitive control (e.g., Lewalter, 2003; Ozsoy, Memis and Temur, 2009). This refers to the processes learners use to monitor, control and regulate their cognition and learning (e.g., Lewalter, 2003; Pintrich, 2002).

Metacognition, first conceptualised by Flavell (e.g., 1976; 1979; see Kaur and Areepattamannil, 2012), is individual knowledge of cognitive processes, products and the active monitoring and consequent regulation of those processes in relation to the cognitive objects or data which they carry (e.g., Boulware-Gooden, Carreker, Thornhill and Joshi, 2007; Kaur and Areepattamannil, 2012; Ozsoy et al., 2009). The construct of metacognition applies to ability to be aware of one's own knowledge, lack of it in various domains and knowing how to make up deficiencies (Laskey and Hetzel, 2010). It emphasises the importance of prior knowledge in determining performance, in particular understanding learning, awareness of one's own learning strengths, weaknesses, as well as the demands of the learning task at hand (Bransford et al., 1999). A metacognitive approach includes self-regulatory activities such as planning, setting goals, organising, checking and evaluation, monitoring, prediction and correction of errors when appropriate, at the various times during learning to help students control and execute their studying processes – all that is necessary for effective intentional learning (e.g., Berkemeyer, 1995; Bransford et al., 1999, Nodoushan, 2012; Shawer, 2012). To sum up, using metacognitive strategies includes planning, monitoring and regulation of cognitive strategies (Kuensting et al., 2013).

Learning strategies are important for many aspects of study, affecting the learning process in both its short- and long-term outcomes.

The usefulness of learning strategies is crucial to student academic outcomes (e.g., Areepattamannil, 2014; Chiu et al., 2007; Laskey and Hetzel, 2010; McInerney et al., 2012; Wong, Ibrahim and Ayub, 2012). For example, students who report using learning strategies were shown to score higher for reading literacy skills (Boulware-Gooden et al., 2007), mathematics and science (Wong et al., 2012).

Further, since educational achievements are strong predictors for later occupational status and income (Martin, 2012), learning strategies relate to students' future labour market performance and overall well--being (OECD, 2012a). The positive relationship between scholastic performance and occupational and income attainments owes much to the fact that the labour market needs highly skilled employees, equipped with knowledge and able to learn (Featherman, 1978). According to Smith, Mikulecky, Kibby, Dreher and Dole (2000) there have been major and rapid changes in labour market demands. Although today's students tend to be smarter, more sophisticated and knowledgeable than previous generations, still, many are not able to cover the skill gap between their abilities and demands of the labour market. A successful professional needs to embrace new literacies such as: proficient use of new technologies, information evaluation, critical analysis or the ability to use a variety of information sources. Thus, young people who have not learnt how to learn may not meet the demands of the labour market (OECD, 2010a).

Student awareness about an optimal pattern for learning strategies may also help to learn efficiently (e.g., Hilberg and Tharp, 2002; OECD, 2010a; Sywelem, Al-Harbi, Fathema and Witte, 2012) and those who are not prepared or motivated for this type of critical thinking and analytical learning may find themselves at risk of low achievement scores, low average school grades or weak and inconsistent academic skills (Laskey and Hetzel, 2010). Learning strategies help students acquire competence and improve their academic skills (Zimmerman and Kitsantas, 2014), to become aware of the multiple solutions to problems, to experiment while finding the answer and how to acknowledge and rectify their own mistakes. Student engagement and on-task time increases, as well as, work completion and accuracy. Learning strategies are also expected to increase student self-esteem, sense of power and responsibility (Beckman, 2002).

For reading literacy, application of at least one learning strategy (e.g., summarising) has a positive influence on comprehension, while simply reading more text does not. Furthermore, comprehension may greatly improve if students are provided with a range of learning strategies accompanying their needs and goals (Berkemeyer, 1995). Good learners can apply an arsenal of learning strategies in a flexible manner, whereas less effective learners often have no access to strategies to help them learn (OECD, 2009a). Alternatively, less effective learners may be able to identify their own strategies, but face problems making appropriate choices or knowing how to link them to form a useful strategy (Kang, 1997). Apart from student benefits, learning strategies have also become important tools for teachers to select appropriate teaching strategies to guide, explain and foster learning throughout the curriculum (Paris and Paris, 2001).

Although learning strategies help learners guide their own learning process and make appropriate independent decisions to improve motivation and heighten self-esteem (Lee, 2002), some strategies may promote learning in different ways and to varying extents (Chiu et al., 2007). The impact of learning strategies is differentiated between domains. For example, according to Kiliç, Çene and Demir (2012) memorisation has a negative effect on educational success in mathematics, while elaboration and control strategies are positive. Kaur and Areepattamannil (2012) have proved the negative impact of memorisation and elaboration strategies and the positive impact of metacognition on mathematical literacy among Australian and Singaporean adolescents. Demir and Kılıç, (2010) have also described negative effects from elaboration on mathematics literacy.

Being a crucial factor influencing school achievement, learning, as well as metacognitive strategies have become a point of interest in wide scale educational research. However, constructing a clear definition and measurement method remains problematic and questionable. The worldwide OECD Programme for International Student Assessment (PISA) assessed learning strategies, dividing them into three areas: control strategies (metacognition), memorisation strategies and elaboration strategies (OECD, 2010a).

Memorisation. Memorisation refers to student tendency to memorise new material in order to be able to reproduce it accurately (OECD, 2010a). These strategies employ methods such as repeating, reciting (Demir and Kiliç, 2010), reading material aloud several times and learning key terms (OECD, 2010a). Memorisation's main function, as a surface learning strategy, is to store information as it is, rather than providing further substantial processing and deep understanding (OECD, 2010a). However, memorising material may play an important role during students' early development by enhancing their memory performance. For example, memorisation of the rules for mathematics improves mastery of essential skills, which form the basis for solving more complex problems (Demir and Kiliç, 2010). The ambiguity of memorisation strategies suggests possible positive outcomes, when employed as memorisation-with-understanding, as opposed to being potentially dysfunctional if used in terms of mechanical memorisation (Sadler-Smith, 1998).

Elaboration. A more sophisticated approach to improve learning and outcomes is to transfer previously acquired knowledge through elaboration. This provides opportunity to improve learning by association with previously acquired material, transferring it to new situations and/or other subjects and recognising whether the information might be useful in real-life situations (e.g., Demir and Kiliç, 2010; Kaur and Areepattamannil 2012; OECD, 2010b). Such transfer requires mental abilities such as abstraction and logical analysis. In general, elaboration helps students to process information more deeply and flexibly transform it to allow successful problem solving (Chiu et al., 2007). However, it is cognitively more demanding and many students find it hard or even impossible to master (e.g., Halpern, 1998).

Metacognition. Metacognitive learning includes processes that primarily focus on revealing sense, self-assessment and reflection on what was successful or needed improvement. These practices have been shown to increase the extent to which students can transfer their learning to new settings and events (Bransford et al., 1999). Control strategies are essential for effective self-regulation because they help students to adapt their methods of learning to a particular task, gaining more control over the process of acquiring knowledge by providing tools to manage their learning later in life (OECD, 2010a).

Understanding how learning strategies influence school achievement is imperative to adapting teaching programs in different domains to maximise learning efficiency.

The present study

The aim of this study is to explore the impact of cognitive and metacognitive learning strategies on Polish students' school performance. The second objective is for comparison with other countries to determine Poland's rank. More specifically, this study attempts to address the following research questions: (a) Do students' learning strategies impact academic achievement? (b) How are the differences between separate learning strategies differentiated in terms of impact on school achievement?

Chiu, Chow and Mcbride-Chang (2007) created a comprehensive multilevel model to estimate effects of student learning strategies on achievement scores in reading, science and mathematics. The authors decided to investigate the 34 countries participating in the PISA 2000 study to estimate the pure, country independent effect of learning strategies. To reveal this effect the model accounted for individual and family background, in-school agents and cultural and country level factors believed to influence academic achievement. Dividing predictors into three levels: student, school and country, allowed control of different sources of variance. The model focused on student level variables: such as gender, history of remedial courses for different subjects, self-belief variables such as self-efficacy, self-concept and locus of control and learning strategies; family background factors: first or second generation immigration, home language spoken, mother's education, parental job status; school level variables and country level variables such as log GDP per capita, GDP inequality Gini index, percentage of GDP spent on public education and two cultural values, degree of egalitarianism and degree of individualism. Controlling for all these variables allowed Chiu et al. (2007) to estimate the effect of the learning strategies on achievement scores.

Methodology and methods

The methodology of this study closely overlaps the Chiu et al. (2007) multilevel model. Their original model was estimated for 34 countries but Poland was not included. The aim of this study was to recreate their model to estimate the impact of learning strategies on Polish student achievement scores and to compare the effect with that in other countries. Using the same model also allowed comparison with the original results.

Data and variables

The model developed by Chiu et al. (2007) was based only on PISA 2000. Four successive rounds of PISA then followed: in 2003, 2006, 2009 and 2012. To ensure generalizable results, the data used needed to be recent. While PISA 2012 offered the most recent data, the 2009 survey was chosen for this analysis, since both PISA 2000 and 2009 focused on reading performance.

The OECD developed PISA which is the most comprehensive and rigorous international study based on a dynamic model for lifelong learning. PISA accounts for both, general and cross-curricular knowledge and skills essential for successful adaptation to a changing world in addition to students' own motivation to learn, their self-belief and learning strategies.

The PISA literacy assessments were designed to cover a broad range of content for reading, mathematics and science. PISA uses the innovative concept of "literacy" as capacity to apply knowledge and skills in key subject areas and to analyse, reason and communicate effectively as students pose, solve and interpret problems in a variety of situations (OECD, 2009b). The construct of literacy is clearly much broader than the historical concept of ability to read and write (Brozo, Shiel and Topping, 2007).

This study draws upon four data sources. The student and school level data were gathered in PISA 2009 study. At country level, additional data was used: economic data from the World Bank (2014) and Heston, Summers and Aten (2009) and cultural values data from the Hofstede, Hofstede and Minkov (2010).

In this present study, beyond the same 34 countries from PISA 2009 used in a general three-level model (Romania and Macedonia were switched with Poland and Slovakia), five two-level regression models for individual countries were also used to compare Poland, the Czech Republic, Hungary, Germany and Slovakia. The main criterion determining selection of the countries was geographical and cultural distance from Poland, which provided a natural regional reference point. This allowed direct comparison within the Visegrád Group (Poland, Czech Republic, Hungary and Slovakia) as the socially and economically closest neighbours and Germany as a country with stronger economy. It has to be stressed that the choice was arbitrary and driven by exploratory reasoning.

Due to changes that took place in PISA over the years, the model had to be slightly modified for application to the PISA 2009 data. Aside from a few questions coded differently, the construct of self-beliefs was omitted in 2009.

To explain the variance of academic achievement in the general model, variables from three levels were used.

Student level variables. The study focused on the effect of learning strategies but aside from that, variables on an individual level were controlled: remedial courses taken in school as a proxy for past student achievement and family variables which included origin from a first or second immigrant generation, foreign language spoken at home, mother's years of schooling and highest parental job status.

School level variables. School-level variables described school environment by conceptualising peer variables as the mean for each student-level variable within every school. The rationale behind this was to provide a mean value for each student-level variable as a reference for an individual student nested within the school.

Country economic and cultural context. Since national economic context proved an important factor for school achievement in the original study, it was required as a control variable. National economic context was described using log GDP per capita, the GDP Gini inequality index and the percentage of GDP spent on public education.

Additionally, countries were differentiated by their position on two cultural dimensions described by Hofstede et al. (2010): collective-individual and hierarchy-egalitarian. The choice of all variables and countries was dictated by Chiu's original model. Variables from all levels for all 34 countries are presented in Table 1.

Analysis

The data was investigated by multilevel analysis using the HLM v. 6.06 package (Raudenbush, Bryk and Congdon, 2005). Three-level hierarchical models were used for each measure of literacy: mathematics, reading and science. The structure of data nesting students within schools and then within countries required a multilevel approach (Garson, 2012). Dependent variables were the first plausible values provided in PISA data on each scale. All variables on the second and third levels were grand mean centred, first--level continuous variables were group centred and first-level dichotomous variables were not centred (Enders and Tofighi, 2007). Missing data were handled by the default HLM procedure: listwise deletion.

Analogously to Chiu's analysis, for each achievement variable, two models were compared, one only with remedial courses and country level variables and the other with the full model. This allowed comparison of how well error variance was explained by student- and school-levels alone, independent of past achievement and the country itself (Table 2).

Models for five individual countries had only two levels, since no variability was shown for country level.

Results

The results from the three-level hierarchical model (Table A1) indicated that country level variables did not influence student achievements in any domain. Based on the analysis of Chiu et al. (2007), GDP was expected to be significant. A large proportion of variance in the reference model was explained by history of remedial courses, which was a negative predictor for academic achievement.

At a school level, mean parental job status was a positive predictor for mathematics and reading, but not science. The mean level of maternal education appears to be strong positive predictor for school achievement in all three domains. Paternal education exerted no such effect. A larger proportion of girls in a school significantly influenced reading and science scores, but not mathematics. Learning strategies used by other students in school were not predictive for academic achievement.

At a student level, attendance of remedial courses adversely predicted both reading and science achievement. Gender was another significant predictor – being female was a negative predictor for mathematics and positive for reading. Metacognitive strategies served as a strong positive predictor for mathematics and reading, but not science. Using elaboration strategies was a negative predictor for mathematics and reading score and use of memorisation negatively predicted mathematics.

It was expected that the effects of learning strategies would differ between domains of academic achievement. Memorisation was expected to be a negative predictor, but contrary to prior assumptions, elaboration proved to be a negative predictor, for which it may be inferred that it impaired academic achievement. This left metacognitive strategies as the only useful approach.

To further analyse the effects of learning strategies, models for individual countries were created. Table 3 presents means and standard deviations for predictors across those five countries. Comparing learning strategies used, the highest score for memorisation was obtained in Hungary, Poland was in second place and Slovakia reported the lowest level. Furthermore, Polish students scored highest for elaboration strategies, slightly ahead of Hungary and Slovakia scored the lowest. German students reported use of metacognitive strategies most frequently, while Slovak students chose this path least frequently.

Although the uptake of learning strategies does not follow any consistent pattern, Hungarian students reported the highest application of learning strategies, whereas Slovak students reported the lowest. Models for individual countries (see Appendix) provide a comparison and reference point for interpreting the coefficients in Poland.

Table 1
*Summary statistics and descriptions of variables**

Variable	*Me*	*SD*	Description
Mathematics score (*n* = 405)	501.41	104.56	Min = 168.18; Max = 754.80. Variable reflects students' mathematical literacy – an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics.
Reading score (*n* = 405)	497.43	108.29	Min = 158.86; Max = 753.44. Variable reflects students' reading literacy – an individuals' capacity to understand, use, reflect on and engage with written texts.
Science score (*n* = 405)	506.91	110.57	Min = 186.07; Max = 756.75. Variable reflects students' science literacy – the ability to create and use conceptual models to make predictions and give explanations, analyse scientific investigations, relate data as evidence, evaluate alternative explanations of the same phenomena and communicate conclusions with precision.
Student level variables			
Reading remedial courses in school (*n* = 371)	0.12	0.32	1 = Reading remedial courses in school.
Other subjects remedial courses in school (*n* = 394)	0.12	0.33	1 = Other subject remedial courses in school.
1st gen immigrant (*n* = 405)	0.11	0.31	1 = First generation immigrant. Student and parents born in another country.
2nd gen immigrant (*n* = 405)	0.07	0.25	1 = Second generation immigrant. Student born in the country of assessment but parent(s) born in another country.
Foreign language (*n* = 405)	0.10	0.31	1 = Foreign language spoken at home
Mather's schooling (*n* = 393)	12.12	3.54	Min = 0; Max = 18. Mother's years of schooling.
Father's schooling (n = 379)	12.19	3.24	Min = 0; Max = 18. Father's years of schooling.
Highest job status (*n* = 394)	50.78	17.39	Min = 16; Max = 88. Student's report on parents' job converted to a number.
Girl (*n* = 405)	0.49	0.50	Student's gender: 1 = girl.
Memorisation (*n* = 401)	0.04	0.92	Min = -3.02; Max = 2.69. The index of memorisation strategies that measures learning practices connected with memorising new material to be able to recite it. Index consists of following items: „I try to memorise everything that is covered in the text", „I try to memorise as many details as possible", „I read the text so many times that I can recite it", „I read the text over and over again", with choices: "almost never", "sometimes", "often" or "almost always".
Elaboration (*n* = 401)	0.03	0.95	Min = -2.41; Max = 2.76. The index of elaboration strategies that measures learning practices connected with relating new material to things: already known and learned in other subjects. Index consists of following items: „I try to relate new information to prior knowledge acquired in other subjects", „I figure out how the information might be useful outside school", „I try to understand the material better by relating it to my own experiences", „I figure out how the text information fits in with what happens in real life", with choices: "almost never", "sometimes", "often" or "almost always".

Metacognition (n = 401)	0.11	1.03	Min = -3.45; Max = 2.50. The index of control strategies that measures learning practices connected with acquiring knowledge which concepts are understood, which are not. Index consists of following items: „I start by figuring out what exactly I need to learn", I make sure that I remember the most important points in the text", „I try to figure out which concepts I still haven't really understood", „I check if I understand what I have read", „I don't understand something, I look for additional information to clarify this", with choices: "almost never", "sometimes", "often" or "almost always".
School level variables (means)			
Mather's schooling (*n* = 388)	12.53	2.25	Min = 5.00; Max = 18.00. School mean of mother's years of schooling.
Father's schooling (*n* = 388)	13.28	2.69	Min = 5.00; Max = 18.00. School mean of father's years of schooling.
Highest job status (*n* = 388)	51.02	18.79	Min = 21.00; Max = 88.00. School mean of highest parents job status.
Foreign language (*n* = 388)	0.09	0.28	Min = 0; Max = 1. School mean of foreign language spoken at home. See above foreign language description.
Girl	0.44	0.50	Schoolmate gender: 1 = girl.
Metacognition (*n* = 388)	0.02	0.93	Min = -3.45; Max = 2.50. Schoolmate use of metacognitive strategies. See above memorisation description.
Elaboration (*n* = 388)	-0.01	0.88	Min = -2.41; Max = 1.50. Schoolmate use of elaboration strategies. See above memorisation description.
Memorisation (*n* = 388)	-0.02	0.99	Min = -3.02; Max = 2.69. Schoolmate use of memorisation strategies. See above memorisation description.
Country level variables			
Log GDP per capita (*n* = 13)	10.15	0.45	Min = 9.39; Max = 10.72. Natural logarithm of gross domestic product per capita (World Bank, 2014).
GDP Gini (*n* = 13)	35.42	7.85	Min = 24.00; Max = 53.30. Measure of the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution (World Bank, 2014). 0 = perfect equality, 1 = perfect inequality.
% GDP on schools (*n* = 13)	11.31	4.70	Min = 3; Max = 19. Percentage of a country's GDP spent on public schools.
Egalitarian (PDI) (*n* = 13)	53.92	22.76	Min = 22; Max = 100. Dimension that expresses the degree to which the less powerful members of a society accept and expect that power is distributed unequally. Large degree of PDI indicates acceptance of a hierarchical order (Hofstede Centre, 2010).
Individualism (IDV) (*n* = 13)	61.08	21.61	Min = 25; Max = 90. Dimension that describes the degree of interdependence a society maintains among its members. Large degree of IDV indicates high preference for a loosely-knit social framework (Hofstede Centre, 2010).

[*] All data are from OECD (2009), unless otherwise specified. Included countries: Albania, Australia, Austria, Belgium, Bulgaria, Brazil, Chile, Czech Republic, Denmark, Finland, Germany, Hong Kong-China, Hungary, Ireland, Iceland, Israel, Italy, Korea, Liechtenstein, Luxembourg, Latvia, Mexico, Netherlands, Norway, New Zealand, Poland, Portugal, Russian Federation, Slovak Republic, Sweden, Switzerland, Thailand, United Kingdom and United States.

Table 2
Unstandardised coefficients, standard errors (in brackets) and standardised coefficients from six multilevel regression models predicting mathematics, reading and science scores

	Mathematics		Reading		Science	
Predictor	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Country level						
	19.319	28.788	21.890	28.029	23.274	25.298
Log GPD per capita	(46.595)	(46.508)	(50.409)	(42.161)	(44.920)	(50.358)
	0.391	0.124	0.438	0.116	0.475	0.103
	-0.451	3.635	-0.241	2.531	-1.121	3.586
GDP Gini	(1.804)	(3.163)	(1.734)	(2.887)	(1.715)	(3.420)
	-0.032	0.273	-0.017	0.183	-0.080	0.255
	-0.380	-3.591	-2.167	-2.551	2.648	-7.215
% GDP on schools	(3.36)	(4.662)	(3.44)	(4.226)	(3.298)	(5.039)
	-0.009	-0.161	-0.048	-0.111	0.060	-0.307
	-1.163	-0.598	-1.672	-0.611	-1.596	-1.053
Egalitarism	(0.967)	(1.233)	(1.030)	(1.119)	(0.918)	(1.333)
	-0.125	-0.130	-0.178	-0.128	-0.173	-0.217
	-1.142	1.333	-1.016	0.760	-1.929	1.830
Individualism	(1.083)	(1.371)	(1.150)	(1.260)	(1.101)	(1.480)
	-0.139	0.276	-0.122	0.152	-0.237	0.358
School level (means)						
		1.033*		1.058*		1.043
Highest job status		(0.525)		(0.519)		(0.556)
		0.186		0.184		0.177
		-6.139		-10.000		-4.921
Metacognitive strategy		(12.182)		(12.172)		(12.923)
		-0.055		-0.086		-0.041
		-7.818		-1.165		-3.080
Elaboration strategy		(11.518)		(11.964)		(12.225)
		-0.066		-0.009		-0.025
		-7.277		-4.980		-14.311
Memorisation strategy		(8.954)		(9.043)		(9.508)
		-0.069		-0.046		-0.128
	-30.289*	-1.581	-34.814***	-21.673	-54.508***	23.305
Remedial courses	(14.222)	(21.505)	(12.088)	(28.238)	(9.967)	(22.893)
	-0.012	-0.006	-0.014	-0.080	-0.022	0.084
		12.893***		12.347***		11.205***
Mother's education		(3.865)		(4.178)		(4.096)
		0.277		0.257		0.228
		6.086		2.981		7.314
Father's education		(3.617)		(3.746)		(3.833)
		0.157		0.074		0.178

		43.671		44.484*		60.617**
Girl		(22.654)		(21.361)		(24.116)
		0.209		0.205		0.274
Student level						
		0.637		-0.820		0.309
Highest job status		(0.478)		(0.711)		(0.584)
		0.106		-0.132		0.049
		36.922***		44.867***		2.651
Metacognitive strategy		(10.01)		(16.326)		(12.322)
		0.364		0.427		0.025
		-33.592***		-42.362***		-16.566
Elaboration strategy		(8.476)		(10.713)		(10.364)
		-0.305		-0.372		-0.142
		-26.048***		-15.711		-10.644
Memorisation strategy		(9.818)		(11.963)		(11.962)
		-0.229		-0.133		-0.089
		-14.426		-42.552***		-31.400***
Remedial courses		(10.47)		(13.771)		(11.744)
		-0.046		-0.130		-0.094
		7.450		11.990		0.035
1st generation immigrant		(13.151)		(13.809)		(14.493)
		0.022		0.034		0.000
		10.728		6.017		8.020
2nd generation immigrant		(16.084)		(17.377)		(17.628)
		0.026		0.014		0.018
		-17.296		-10.435		-14.818
Foreign language		(14.018)		(13.886)		(15.531)
		-0.051		-0.030		-0.042
		-1.958		-0.136		-1.362
Mother's education		(1.726)		(2.278)		(2.127)
		-0.066		-0.004		-0.044
		1.599		6.726		1.059
Father's education		(2.481)		(4.921)		(3.025)
		0.050		0.201		0.031
		-28.458***		24.429**		-14.438
Girl		(8.75)		(9.461)		(9.445)
		-0.136		0.113		-0.065
Variance explained						
Student	0.20	0.05	0.11	0.06	0.16	0.07
School	0.41	0.59	0.49	0.64	0.45	0.56
Country	0.38	0.36	0.40	0.30	0.39	0.38

Table 3
Descriptive statistics for Czech Republic, Poland Germany, Hungary and Slovakia

Predictor	CZE		DEU		HUN		POL		SVK	
Student level	*Me*	*SD*	*Me*	*SD*	*Me*	*SD*	*Me*	*SD*	*Me*	*SD*
Highest job status	50.55	14.11	49.17	15.53	47.89	15.49	45.51	15.90	45.80	14.05
Metacognitive strategy	0.05	0.90	0.19	0.97	0.11	0.89	0.10	0.94	-0.11	0.92
Elaboration strategy	0.15	0.93	0.09	0.94	0.19	0.92	0.25	0.92	-0.04	0.91
Memorisation strategy	0.13	0.98	0.21	0.88	0.73	0.90	0.42	0.88	-0.35	1.05
Remedial courses	0.10	0.29	0.14	0.35	0.05	0.23	0.12	0.32	0.11	0.31
1st generation immigrant	0.01	0.10	0.06	0.23	0.01	0.10	0.00	0.01	0.00	0.05
2nd generation immigrant	0.02	0.12	0.11	0.31	0.01	0.10	–	–	0.00	0.06
Foreign language	0.02	0.13	0.09	0.29	0.01	0.09	0.01	0.08	0.05	0.23
Mother's education	13.22	1.92	13.15	3.42	12.31	2.86	11.99	2.29	12.78	2.20
Father's education	13.16	2.00	13.82	3.37	12.13	2.67	11.64	2.14	12.79	2.21
Girl	0.49	0.50	0.49	0.50	0.50	0.50	0.50	0.50	0.51	0.50
School level (means)										
1st generation immigrant	0.01	0.11	0.03	0.17	0.01	0.10	–	–	–	–
2nd generation immigrant	0.02	0.13	0.07	0.26	0.02	0.13	–	–	0.01	0.07
Foreign language	0.01	0.09	0.06	0.24	0.01	0.10	0.01	0.07	0.07	0.26
Mother's education	13.25	1.94	13.13	3.33	12.10	2.94	12.22	2.15	12.78	2.08
Father's education	13.10	1.92	13.88	3.15	11.82	2.71	11.86	1.99	12.94	2.19
Highest job status	50.60	14.23	49.12	13.98	45.74	16.29	44.79	16.24	45.56	13.56
Girl	0.51	0.50	0.43	0.50	0.42	0.50	0.48	0.50	0.54	0.50
Memorisation strategy	0.19	1.01	0.29	0.87	0.69	0.88	0.41	0.90	-0.47	1.14
Elaboration strategy	0.21	0.90	0.17	0.94	0.16	0.99	0.28	0.92	-0.09	0.97
Metacognitive strategy	0.09	0.86	0.23	1.02	-0.00	0.99	0.04	0.91	-0.16	0.91
Mathematics	516.55	97.12	515.95	96.20	495.59	88.96	499.22	88.19	497.40	94.03
Reading	501.54	94.70	500.86	92.78	499.46	86.84	505.12	88.47	478.36	89.06
Science	525.42	96.99	525.06	97.24	507.75	82.81	512.11	86.73	492.43	92.60

At a peer (Chiu uses the term "schoolmates") level, significant predictive variables were: parental job status (Czech, Hungary, Germany and Poland), mothers' education level (Germany, Hungary and Poland), fathers' education level (Czech, Poland and Slovakia) and proportion of girls in school (Czech and Poland). The level of application of metacognitive strategy was a positive predictor for academic achievement in every country and every domain except for mathematics in Czech. Elaboration was only a significantly negative in Poland and memorisation was significant negative in the Czech Republic, Germany and Slovakia.

Parental job status was a significant positive predictor on student level for all domains in the Czech Republic, Poland and Slovakia and for reading in Hungary. Mothers' education was only found to be a positive predictor in Poland and for mathematics in Hungary. Fathers' education was predictive for all domains in Germany and Poland and for science in Hungary and Slovakia. Remedial courses were a negative predictor in all countries. Immigrant status was negative in the Czech Republic and Germany and a positive predictor in Poland and Slovakia. Using foreign language at home was a negative predictor in all domains in Slovakia, reading and science in Poland, science in Germany and mathematics in Hungary, creating a rather inconsistent picture between countries, unlike being a girl, which followed the same pattern in all countries: an advantage for reading and a disadvantage for mathematics and science.

Of the learning strategies analysed, memorisation seems universally negatively predictive in all domains for all countries, as opposed to the beneficial effect shown by metacognitive strategies, positive in all domains, in all countries studied. Elaboration was positive, predicting mathematics and science in Hungary, the Czech Republic, Germany and Slovakia but negative for reading in Poland and Hungary. Although the effect of elaboration is not as consistent as for memorisation and metacognitive strategies, it is clear that its direction of influence is domain dependent.

The results proved that choice of learning strategies in individual countries indeed engendered important consequences for academic achievement.

Discussion and conclusions

A comprehensive model based on similar research by Chiu et al. (2007) was developed to interpret the effect of learning strategies on academic achievement. The results acquired from both, general and individual country models provided further evidence that the effect of learning strategies on academic achievement is complex.

The control of country- and school-level variables is imperative and driven by the nested structure of the data, however, this seems insufficient. Although controlling for peer variables as indicators for the school environment seems a reasonable step, effects were not universal and school-level effects varied between countries. Despite the fact that Chiu et al. (2007) acquired similarly varying results, the pattern was slightly different than was expected. Some general effects from the original research were replicated. Peer-group maternal education was again predictive for all academic achievement. The use of memorisation strategies was, in general, associated with lower scores in all academic achievement domains. This effect can be seen in both general and individual models. Although the adoption of elaboration strategies was a significant predictor, the effect was incoherent in the general model, yet reasonable in individual models. As expected, the use of metacognitive strategies proved to be a positive predictor of school achievement in all domains. The negative effect of metacognitive strategies used by peers begs further analysis.

Memorisation strategies were expected to offer negative prediction in all domains (e.g., Kaur and Areepattamannil, 2012; Chiu et al., 2007; Czuchry and Dansereau, 1998; Kiliç et al., 2012; Law et al., 2008), being considered the least effective. The influence of elaboration strategies was rather unexpected. In the general model it was strongly negative compared to the "disappointingly but not surprisingly" small effect obtained by Chiu et al. (2007, p. 359), interpreted as a consequence of its difficulty for students to apply (e.g., Halpern, 1998). Further, unskilled use of this strategy (especially by copying material rather than using it in meaningful ways) might render learning using a flawed approach closer to simple memorisation at the expense of efficiency (Schunk and Zimmerman, 2003).

Analysis of individual countries offers more insight into the effect of the elaboration strategy, rendering it more comprehensive and comparable. This evidence points to other, unknown factors beyond those controlled for in the general model. Their influence on the impact of learning strategies can be excluded in the analysis of individual similar countries. It might be reasonable to analyse effects of learning strategies, restricted to similar cultural, educational and social contexts until these factors are better understood.

Interpreting the differences between individual countries in those contexts might provide a better understanding of variations in the effects of predictors on academic achievement. For example, the disparity in the effect of immigrant or immigrant dependent status between the Czech Republic and Germany and Hungary, Poland and Slovakia may reside in the extent of assimilation. Learning strategies are more likely to be dependent not only on the organisation of the educational system, but also on cultural values not embodied in the model presented (Hofstede et al., 2010). Observed differences might be impossible to explain, since their aetiology is unknown at this stage. The variables accountable for the differences in the effect of the learning strategies on academic achievement might exist at student, school or country levels. Some hypotheses (e.g., Chiu et al., 2007; Rockoff, 2004; Sanders, Wright and Horn, 1997) aim to explain those differences by the effects of the teachers characteristics and the way they teach students. Recently, PISA introduced an additional construct for teaching strategies (OECD, 2012b) to allow future investigation.

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Appendix

Table A1

Unstandardised coefficients, standard errors (in brackets) and standardised coefficients from multilevel models predicting mathematics, reading and science scores in Czech Republic, Germany, Hungary, Poland and Slovakia

	CZE			DEU			HUN			POL			SVK		
Predictor	Maths	Reading	Science	Maths	Reading	Science	Maths	Reading	Science	Maths	Reading	Science	Maths	Reading	Science
School level (means)															
Highest job status	1.674***	1.469***	1.450***	0.732*	0.667	0.562	2.003***	1.677***	1.58***	0.408	0.456*	0.402	0.246	0.366	0.358
	(0.305)	(0.275)	(0.293)	(0.363)	(0.340)	(0.354)	(0.389)	(0.383)	(0.376)	(0.243)	(0.223)	(0.222)	(0.326)	(0.292)	(0.308)
	0.243	0.219	0.211	0.118	0.112	0.090	0.349	0.299	0.296	0.074	0.082	0.074	0.037	0.058	0.054
Meta--cognitive strategy	9.790	12.180**	12.971**	13.967**	13.669***	11.497*	14.631*	18.935***	13.325*	11.767***	13.979***	11.498***	23.051***	25.723***	25.713***
	(5.780)	(4.928)	(5.160)	(5.320)	(4.746)	(5.077)	(6.734)	(6.422)	(6.199)	(4.074)	(3.731)	(3.717)	(6.597)	(5.890)	(6.320)
	0.091	0.116	0.120	0.141	0.143	0.115	0.146	0.194	0.143	0.125	0.149	0.125	0.226	0.266	0.255
Elaboration strategy	5.002	4.282	5.239	-4.188	-6.253	-3.054	-2.824	-5.136	-3.888	-9.784**	-10.531***	-8.147**	-10.349	-10.189	-10.103
	(5.524)	(4.969)	(5.285)	(5.335)	(4.690)	(5.337)	(6.362)	(6.210)	(5.883)	(3.754)	(3.438)	(3.427)	(5.970)	(5.567)	(5.724)
	0.048	0.042	0.050	-0.041	-0.063	-0.030	-0.029	-0.054	-0.043	-0.102	-0.110	-0.086	-0.100	-0.104	-0.099
Memorisa-tion strategy	-17.466***	-16.92***	-16.72***	-17.351***	-15.289**	-16.468***	-3.348	-6.103	-4.608	-4.088	-5.087	-4.486	-17.137***	-17.355***	-18.156***
	(3.892)	(3.547)	(3.978)	(6.206)	(5.823)	(6.233)	(7.333)	(7.246)	(6.800)	(3.539)	(3.241)	(3.230)	(3.535)	(3.069)	(3.400)
	-0.176	-0.175	-0.169	-0.159	-0.145	-0.149	-0.034	-0.063	-0.050	-0.041	-0.051	-0.046	-0.191	-0.205	-0.206

Remedial courses	-3.960	-4.067	-7.862	-1.026	3.272	-2.450	-6.277	-16.768	-17.393	-2.424	-3.668	-7.526	-8.703	-4.442	-7.691
	(9.310)	(9.188)	(11.038)	(13.202)	(11.554)	(12.283)	(19.069)	(20.416)	(19.627)	(8.490)	(7.788)	(7.772)	(13.400)	(13.173)	(14.686)
	-0.012	-0.012	-0.024	-0.004	0.012	-0.009	-0.016	-0.044	-0.048	-0.009	-0.013	-0.028	-0.029	-0.015	-0.026
Foreign language	20.571	0.679	2.139	6.607	9.978	1.280	-6.126	-3.066	-17.835	39.166	51.272	51.383	-14.890	-20.487	-22.975
	(27.754)	(17.452)	(21.170)	(17.348)	(17.065)	(20.388)	(95.231)	(91.119)	(96.154)	(34.141)	(31.228)	(31.092)	(15.411)	(10.442)	(14.542)
	0.028	0.001	0.003	0.020	0.031	0.004	-0.006	-0.003	-0.019	0.036	0.046	0.047	-0.036	-0.053	-0.057
Mother's education	1.618	0.268	1.265	4.471**	5.177***	5.415***	5.147**	4.573*	4.127*	4.607**	4.744***	4.894***	-0.007	-0.896	-0.545
	(2.032)	(1.916)	(1.993)	(1.797)	(1.602)	(1.701)	(2.158)	(2.183)	(2.090)	(1.798)	(1.649)	(1.645)	(2.536)	(2.170)	(2.475)
	0.032	0.005	0.025	0.159	0.191	0.190	0.165	0.151	0.143	0.120	0.123	0.129	0.000	-0.022	-0.013
Father's education	4.479*	4.674*	4.623	1.511	1.000	1.349	1.962	2.904	3.201	3.880*	2.756	3.026	4.920*	4.171*	4.530*
	(2.257)	(2.153)	(2.366)	(2.031)	(1.845)	(1.988)	(2.603)	(2.484)	(2.677)	(1.778)	(1.630)	(1.625)	(2.229)	(2.047)	(2.103)
	0.092	0.099	0.095	0.053	0.036	0.047	0.059	0.089	0.103	0.094	0.067	0.075	0.116	0.104	0.108
Girl	31.218***	26.114***	28.498***	12.389	16.674	14.760	12.262	13.843	13.301	11.701*	12.963***	11.528**	7.914	6.180	10.114
	(8.156)	(7.058)	(7.751)	(9.445)	(8.754)	(9.457)	(9.277)	(9.356)	(8.878)	(5.295)	(4.850)	(4.834)	(8.757)	(7.874)	(8.401)
	0.161	0.138	0.147	0.064	0.090	0.076	0.069	0.080	0.080	0.066	0.073	0.066	0.042	0.035	0.055

Student level															
Highest job status	0.904***	0.879***	0.700***	0.117	0.062	0.136	0.147	0.430***	0.127	0.675***	0.661***	0.576***	0.823***	0.748***	0.515***
	(0.089)	(0.090)	(0.094)	(0.080)	(0.078)	(0.081)	(0.078)	(0.071)	(0.076)	(0.101)	(0.097)	(0.100)	(0.102)	(0.090)	(0.100)
	0.133	0.132	0.103	0.017	0.009	0.020	0.027	0.081	0.025	0.124	0.121	0.108	0.119	0.114	0.075
Meta-cognitive strategy	13.047***	14.455***	15.816***	7.631***	10.992***	10.382***	3.368***	7.934***	4.531***	24.341***	25.359***	22.392***	13.564***	15.907***	12.772***
	(1.365)	(1.298)	(1.49)	(1.283)	(1.308)	(1.364)	(1.251)	(1.288)	(1.283)	(1.678)	(1.613)	(1.667)	(1.501)	(1.500)	(1.614)
	0.116	0.131	0.140	0.081	0.121	0.109	0.037	0.090	0.054	0.251	0.261	0.235	0.131	0.163	0.126
Elaboration strategy	4.850***	1.065	5.265***	4.360***	-2.212	4.534***	3.768***	-2.710**	5.258***	-2.625	-3.714**	-0.364	3.09**	-1.245	3.251**
	(1.179)	(1.156)	(1.241)	(1.220)	(1.141)	(1.179)	(1.164)	(1.099)	(1.033)	(1.508)	(1.449)	(1.498)	(1.292)	(1.286)	(1.371)
	0.045	0.010	0.049	0.043	-0.022	0.044	0.042	-0.031	0.063	-0.027	-0.039	-0.004	0.032	-0.014	0.034
Memorisation strategy	-11.002***	-9.017***	-13.319***	-12.262***	-7.581***	-12.168***	-8.054***	-5.775***	-10.503***	-16.000***	-11.398***	-11.754***	-17.696***	-14.091***	-17.859***
	(1.064)	(1.027)	(1.175)	(1.430)	(1.392)	(1.477)	(1.244)	(1.351)	(1.274)	(1.587)	(1.525)	(1.576)	(1.046)	(0.982)	(1.058)
	-0.114	-0.096	-0.139	-0.111	-0.071	-0.109	-0.080	-0.059	-0.112	-0.163	-0.116	-0.122	-0.215	-0.180	-0.220
Remedial courses	-21.219***	-18.962***	-21.983***	-19.339***	-19.229***	-25.917***	-30.135***	-18.669***	-20.453***	-31.535***	-26.039***	-26.720***	-2.871	-10.801***	-12.245***
	(2.827)	(2.681)	(2.776)	(3.364)	(3.081)	(3.203)	(3.838)	(3.894)	(3.953)	(3.590)	(3.446)	(3.560)	(3.414)	(3.188)	(3.396)
	-0.066	-0.060	-0.068	-0.068	-0.070	-0.091	-0.102	-0.064	-0.074	-0.111	-0.091	-0.096	-0.009	-0.036	-0.040
1st generation immigrant	-27.788***	-26.596**	-38.325***	-21.938***	-29.9***	-28.29***	-0.860	0.787	-0.273	–	–	–	10.461	37.710*	4.648
	(9.607)	(10.231)	(9.932)	(6.411)	(5.848)	(6.282)	(6.804)	(7.561)	(7.693)	–	–	–	(22.334)	(18.418)	(13.936)
	-0.029	-0.028	-0.040	-0.052	-0.074	-0.067	-0.001	0.001	0.000	–	–	–	0.006	0.021	0.003

	-37.943***	-20.091**	-31.864***	-16.917***	-17.348***	-30.195***	-12.806	-3.806	-8.892	161.706*	89.003	188.9**	4.592	49.429***	24.579*
2nd generation immigrant	(8.848)	(8.097)	(10.099)	(4.764)	(4.723)	(4.768)	(8.838)	(7.782)	(8.554)	(74.290)	(71.345)	(73.731)	(13.017)	(9.689)	(12.282)
	-0.047	-0.025	-0.039	-0.055	-0.058	-0.096	-0.014	-0.004	-0.011	0.000	0.000	0.000	0.003	0.033	0.016
	2.480	6.280	9.849	-3.771	-5.133	-13.802**	-19.068*	-12.455	2.766	-12.157	-39.990***	-44.774***	-16.727*	-22.677***	-17.288*
Foreign language	(8.841)	(9.272)	(9.251)	(5.322)	(5.503)	(5.676)	(9.514)	(6.972)	(8.570)	(15.58)	(14.963)	(15.463)	(7.882)	(6.559)	(7.997)
	0.002	0.006	0.009	-0.009	-0.013	-0.034	-0.021	-0.014	0.003	-0.010	-0.032	-0.036	-0.046	-0.066	-0.049
	-0.641	-1.116	0.127	0.589	0.698	0.794	1.829***	0.838	0.715	4.945***	4.743***	5.153***	0.160	-0.441	0.492
Mother's education	(0.549)	(0.604)	(0.624)	(0.406)	(0.389)	(0.41)	(0.449)	(0.434)	(0.437)	(0.693)	(0.666)	(0.688)	(0.591)	(0.511)	(0.630)
	-0.013	-0.023	0.003	0.020	0.025	0.027	0.060	0.028	0.025	0.121	0.115	0.128	0.004	-0.010	0.011
	-0.440	0.179	-0.715	1.705***	1.870***	1.807***	-0.745	0.451	1.192***	3.159***	3.455***	4.553***	1.094	0.161	2.021***
Father's education	(0.532)	(0.537)	(0.508)	(0.380)	(0.389)	(0.383)	(0.462)	(0.448)	(0.449)	(0.688)	(0.661)	(0.683)	(0.711)	(0.645)	(0.698)
	-0.009	0.004	-0.014	0.056	0.063	0.059	-0.023	0.014	0.039	0.071	0.078	0.104	0.025	0.004	0.048
	-21.511***	29.912***	-9.528***	-23.499***	28.221***	-15.073***	-23.274***	23.316***	-12.542***	-11.999***	39.521***	-3.106	-12.894***	38.613***	-10.462***
Girl	(2.078)	(2.116)	(2.210)	(2.172)	(1.962)	(2.154)	(1.823)	(1.656)	(1.713)	(2.310)	(2.219)	(2.293)	(2.516)	(2.258)	(2.566)
	-0.111	0.158	-0.049	-0.122	0.152	-0.078	-0.131	0.134	-0.076	-0.068	0.223	-0.018	-0.069	0.217	-0.056
Variance explained															
Student level	0.50	0.57	0.57	0.44	0.47	0.45	0.45	0.43	0.46	0.85	0.87	0.88	0.62	0.62	0.64
School level	0.50	0.43	0.43	0.56	0.53	0.55	0.55	0.57	0.54	0.15	0.13	0.12	0.38	0.38	0.36